TITLE

WEB-BASED APPARATUS AND METHOD FOR ENHANCING AND MONITORING PICTURE ARCHIVING AND COMMUNICATION SYSTEMS

CROSS REFERENCE TO RELATED APPLICATIONS (if applicable)

Not Applicable.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH & DEVELOPMENT (if applicable)

Not Applicable.

BACKGROUND OF THE INVENTION

The present invention relates generally to improvements in Picture Archiving and Communication Systems ("PACS") and in particular to a web-based apparatus and method for remotely enhancing and monitoring a PACS.

Picture Archiving and Communication Systems are used for, among other things, storing, observing and analyzing images obtained in medical applications. PACS may be used with several technologies for observing the interior anatomy of a living being, for example with ultrasound, x-ray or PET images and the like. When using a Picture Archiving and Communication System, it may be desirable for several workstations at a hospital, clinic or laboratory, for example, to have access to PACS images and software to view and/or analyze the images.

Because of the rapid improvements in software for viewing and analyzing such images, it is often desirable to install or update software at each of the several workstations within a hospital. Because software bugs are also often detected after computer software is installed in the workstations, it is often necessary for an engineer to install software to "fix" or correct the bug. Such fixes or corrections are called

software patches. Unfortunately, the process of installing the software or software patches on each of the workstations within a single hospital can be very costly and time-consuming. In the past, a field engineer would have to travel to each of the workstations individually and install software or software patches (as indicated in part in Figure 1). Because each individual hospital may have 150 to 200 workstations or more, this process was very time-consuming and expensive. Moreover, the field engineer would have to be physically present at the hospital to install the software, which may take more of the engineer's time and cost even more money. Also, in some of the hospitals the computer may be present on different floors or other parts of the building which make the installation even more tedious. For example, the amount of the engineer's time taken to install software or software upgrades may be represented as:

$$\text{Time to upgrade N systems} = (T * N) + X + Y * (N - 1);$$

where T is the time to install the software, N is the number of computers to be upgraded, X is the time taken for the FE to travel to and from to the site, and Y is the average time taken for the engineer to go from one computer to another.

Additionally, errors often occur when using Picture Archiving and Communication Systems in, for example, both the software and the display of images on individual workstations. Because the person utilizing the workstation, normally a radiologist or technician, cannot analyze and determine the source of the error, a field engineer must travel to the location of the workstation to determine the source of the error. Additionally, the engineer may have to look separately at several different workstations before finding the source of the error. Such errors may often be detected by reviewing log files, i.e., files that indicate the users of a workstation and when the users logged on and off. As a result, it is very costly and time-consuming for the field engineer to trouble-shoot errors occurring at individual workstations.

Past PACS and computer technology has not presented a Picture Archiving and Communication System or method used therewith that avoids the aforementioned

problems of high cost and time consuming software installation on workstations and trouble-shooting of errors on individual PACS workstations.

A need has long existed for such a Picture Archiving and Communication System and method. A further need remains for an improved Picture Archiving and Communication System and method that enable a field engineer to remotely install software and to remotely find and correct errors in individually workstations. It is an object of the present invention to meet these and other needs.

BRIEF SUMMARY OF THE INVENTION

In an exemplary embodiment of the present invention, a method for remotely enhancing a picture archiving communication system (PACS) is provided. The method includes establishing an Internet connection with a server. The method also includes directing the server to simultaneously install software to a plurality of PACS workstations and simultaneously installing software to the plurality of PACS workstations. The method may optionally include, in the directing step, instructing the server to install at least one software update to the plurality of workstations. The method may also optionally include, in the establishing step, logging on to a web server and authenticating a user. The method may additionally optionally include sending an indication message to a remote user to indicate whether the software installation was successful.

In another exemplary embodiment of the present invention, a method for remotely monitoring a picture archiving communication system (PACS) is provided. The method includes establishing an Internet connection with a server, directing the server to retrieve data from at least one file from at least one of a plurality of PACS workstations, retrieving the data from the at least one file, and transmitting the data to a remote user.

Another alternative embodiment of the present invention provides an apparatus for remotely enhancing a picture archiving communication system including a remote first terminal in communication with a web-based server. The remote first terminal generates a remote signal. The apparatus also includes a plurality of PACS workstations connected to the web-based server, and the web-based server comprises an installer for simultaneously installing software to the plurality of PACS workstations responsive to the remote signal.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 illustrates a block diagram of a prior art picture archiving communication system (PACS).

Figure 2 illustrates a block diagram of an apparatus for remotely enhancing a picture archiving communication system according to a particular embodiment of the present invention.

Figure 3 illustrates a block diagram of an apparatus for remotely monitoring a picture archiving communication system according to an alternative embodiment of the present invention.

Figure 4 illustrates a block diagram of a method for remotely enhancing a picture archiving communication system according to another alternative embodiment of the present invention.

Figure 5 illustrates a block diagram of a method for remotely monitoring a picture archiving communication system according to yet another alternative embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Figure 2 illustrates a PACS enhancing apparatus for remotely enhancing a picture archiving communication system 200. The apparatus 200 includes a remote terminal 202, a remote signal 203, and an Internet connection 204. The apparatus 200 also includes a web-based server 206, which contains an installer 208. The web-based server 206 as shown in a preferred embodiment in Figure 2 is in communication with several workstations 210, number 1 through N in Figure 2.

Figure 3 illustrates a PACS monitoring apparatus for remotely monitoring a picture archiving communication system 300. The PACS monitoring apparatus 300 differs from the PACS enhancing apparatus 200 in that instead of an installer 208, the PACS monitoring apparatus 300 includes a data retriever 302 for retrieving data from the plurality of PACS workstations 210.

Figure 4 depicts a method for remotely enhancing a PACS 400 including an establishing step 402, a logging on step 403, a directing step 404, an installing step 406 and a sending step 408. The method corresponds to the PACS enhancing apparatus 200 of Figure 2. Figure 5 depicts a method for remotely monitoring a PACS 500 including the establishing step 402 and logging on step 403. The method 500 also includes a retrieval directing step 502, a search directing step 503, a retrieving data step 504 and an extracting step 505. The method 500 of Figure 5 further includes a transmitting step 506 and a periodic updating step 507. The monitoring method 500 corresponds to the PACS monitoring apparatus 300 of Figure 3.

Turning back to Figure 2, a user at the remote terminal 202 may connect to the web-based server 206 via an Internet connection 204. In a preferred embodiment, the user at the remote terminal 202 communicates with the web-based server 206 via an Internet connection 204 using, for example, a land-line or a cellular connection. The remote terminal 202 may include, for example, a laptop computer (preferably with a CD-ROM drive). In a preferred embodiment, the remote user may be in a different city or country from the web-based server 206 (which will normally be at the location of the workstations 210). It is still advantageous, however, if the user is present at the site of the server 206, since the time of traveling between each of the workstations 210

will be saved, as will be further discussed below. Establishing the Internet connection corresponds to the step 402 of Figures 4 and 5.

In the typical application, the Internet communication may be over a private Internet arrangement created by, for example, a hospital. Because of the confidential nature of hospital records, the Internet connection may preferably only be made by authenticating the user using, for example, a login name and password. The process of logging on to the web server 206 and authenticating the user corresponds to the logging on and authenticating step 403 of Figures 4 and 5.

Once the Internet connection is established, the remote user may confirm that he or she is connected to the proper server and in turn able to download information to the desired workstations. At some point the remote user will make available at the remote terminal 202 software or a software patch for downloading to the workstations 210. The remote user may make the software available, for example, by placing it in a CD-ROM drive connected to the remote terminal 202.

The remote user may then instruct the web-based server 206 to install the software on one or more of the workstations 210. In the preferred embodiment, the remote user will then instruct the web-based server 206 to simultaneously install the desired software or software patch, for example, onto all of the workstations 210. The instruction may come, for example, in the form of a click with a mouse on an "install" icon on a monitor at the remote terminal 202. The installer 208 will then install the software onto each of the workstations 210. The number of workstations is generally set, for example, by the hospital or laboratory where the workstations 210 are located, and may number 150-200 or more based on need. The number of workstations 210 to which the software may be installed is not, however, limited except by the limitations of the web-based server 206 and installer 208. The instructions to install and the installation of the software correspond to the directing step 404 and simultaneous installing step 406 of Figure 4.

Once the installation is complete, the apparatus 200 may be configured such that the web-based server 206 may send a message to the remote terminal 202, indicating whether the software installation was successful, as shown in step 408 of Figure 4.

As a result of the improved apparatus 200 and method 400, a field engineer may install software much more quickly and at considerably less expense than in the prior art method of Figure 1. First, the field engineer need not travel to the location of the workstations 210 to install the software or software updates, as was required in prior art methods. This saves both traveling time and traveling cost for the field engineer. Second, the field engineer may install the software simultaneously to several workstations, thereby saving the time necessary to travel between the several workstations (which may number between 150 and 200 or more). Third, the field engineer need not wait for the installation to be over. He or she may check later to see if the installation was successful. This also saves the time necessary for the field engineer to separately install the software onto each of the workstations 210. As a result, the field engineer may perform the installation of software onto N workstations 210 in a time equal to:

$$\text{Time to upgrade N workstations} = T + X + Y;$$

where T is the time taken to install the software, N is the number of workstations to be upgraded, X is the time it takes the remote terminal 202 to copy the file(s) to the web-based server 208 and Y is the sum of time it takes for the web-based server to push or copy the files to the desired workstations 210. As a result, Y is directly proportional to N. Once the files are pushed to the workstations 210, the installer 208 may then simultaneously install the files to the workstations 210. This is considerably less than the time taken for the field engineer to travel to each workstation individually and update the software, which as described above was:

$$\text{Time to upgrade N workstations manually} = (T * N) + X + Y * (N - 1).$$

Turning again to Figures 3 and 5, in another embodiment of the present invention, it is desirable to monitor the PACS, for example for errors or to search, extract or download files of interest. In the embodiment of Figure 3, the web-based server 206 is provided with a data retriever 302 for retrieving data from one or more of the PACS workstations. The apparatus 300 and method 500 of Figures 3 and 5,

respectively, operate in a somewhat similar way to the apparatus 200 and method 400 of Figures 2 and 4. In the remote monitoring apparatus of Figure 3, however, the web-based server 206 and data retriever 302 respond to the instructions from the remote terminal 202 by retrieving data from one or more of the plurality of PACS workstations 210.

In a preferred embodiment, the web-based server 206 and data retriever 302 respond to instructions from the remote terminal 202 to extract files form one or more of the workstations 210. Such an extraction may be desired, for example, when an error occurs at one of the workstations 210. Errors often occur in PACS workstations and may occur in image files or in the process of analyzing image files at the workstation 210. One way to detect such errors is for a field engineer to analyze a log file from the workstation 210 where the error occurs. By analyzing the log file, which tracks the desired log message when an error occurs, the engineer may determine the cause of the error and be able to correct it remotely. When an error occurs in an image file, the engineer may remotely extract the image as well, by instructing the web-based server 206 and data retriever 302 to do so. The engineer may then locate and correct the error remotely, without traveling to the location of the workstations 210. As a result, the same benefits achieved when the apparatus for remotely enhancing a PACS 200 and the method for remotely enhancing a PACS 400 may be achieved when using the apparatus 300 and method 500 for remotely monitoring a PACS.

For example, referring still to Figures 3 and 5, once the Internet connection is established with the engineer at the remote terminal 202, the engineer using the remote terminal 202 may direct the server 206 to retrieve data from a PACS workstation 210, as illustrated in step 502. This may include directing a search for a predetermined message, for example an error message, as illustrated in step 503 of Figure 5. Once the desired data is located, the server 206, in conjunction with the data retriever 302, may retrieve the data (for example a file), as indicated in steps 504 and 505. The data or file may then be transmitted to the remote terminal 202 for analysis and, for example, to locate any errors. This process may be periodically repeated or updated as illustrated by the periodic updating step 507 of Figure 5. The process may be repeated, for example, every five or ten minutes.

Referring generally to Figures 2 through 5, the components of the remote terminal 202, web-based server 206, installer 208, workstations 210 and data retriever 302 may be implemented using combinatorial logic, an ASIC, through software implemented by a CPU, a DSP chip, or the like. Additionally, the foregoing hardware elements may be part of hardware that is used to perform other operational functions. The remote signal 203, log files, image files, installed software and software patches may be stored in registers, RAM, ROM, or the like, and may be generated through software, through a data structure located in a memory device such as RAM or ROM, and so forth.

While particular embodiments of the invention have been shown, it will be understood, of course, that the invention is not limited thereto since modifications may be made by those skilled in the art, particularly in light of the foregoing teachings. It is, therefore, contemplated that the appended claims will cover any such modifications as incorporate those features that constitute the essential features of these improvements within the true spirit and the scope of the invention.